

Average wage level as a new port performance indicator: A method and illustration of U.S. port counties

*Presented at the International Association of Maritime Economists (IAME) Conference
“Challenges and Trends in Shipping: Markets, Investments and Policies”, Athens,
Greece, July 4-7 2007*

César DUCRUET, PhD*
Bianca DUMAY
Peter W. De LANGEN, PhD**

Erasmus University Rotterdam
School of Economics, Faculty of Applied Economic
Burg. Oudlaan 50, Woudestein
P.O. Box 1738, 3000 DR Rotterdam, The Netherlands

Abstract

Port-related impacts are often presented in terms of quantity, e.g. employment generated in the port. The quality of jobs, in terms of average wage level is hardly discussed. This is surprising given the fact that most economists (and macro-economic models) assume labour markets work relatively efficiently. Thus, it is assumed people employed in the port would not be employed elsewhere if there was no employment in the port sector. This paper argues that in advanced economies, the average wage level is a better indicator of the role of ports in realizing economic wealth in a given area. Methodological issues are discussed and an empirical analysis of US port counties is presented. Results show that average wage level in core activities - transport and warehousing - are related to the size of the counties (e.g. population and workforce) and to their economic specialization. Notably, specializing in freight-related activity strengthens wage levels while additional specializations such as manufacturing, trade, and logistics are associated with lower performance of port counties. These patterns may be explained by the importance of central place over coastal locations in the firms' networks in terms of spatial division of labor.

Keywords: Average wage level, County, Impact, Performance, Port, USA

* Corresponding author: ducruet@few.eur.nl; Tel. +31 (0)10-408-1678 / Fax +31 (0)10-408-9141

** Presenter, Port of Rotterdam authority

AVERAGE WAGE LEVEL AS A NEW PORT PERFORMANCE INDICATOR; A METHOD AND ILLUSTRATION OF U.S. PORT COUNTIES

1. INTRODUCTION

Ports, alike other major transport infrastructures, are known to have an impact on local and regional employment, trade, and the economy as a whole (Banister 1995). However, “convincing studies on this topic are scarce” (De Langen 2005). Reasons for that include the lack of methodology but, also, the growing gap between scholars’ perception of port impact and the reality of the port itself. On one hand, most studies on port-related employment define the impact in quantitative terms by assessing how many jobs are created locally and regionally by the port. This focus on employment quantity is surprising given the fact that most economists (and macro-economic models) assume labor markets work relatively efficiently. Thus, it is assumed people employed in the port would not be employed elsewhere if there was no employment in the port sector. No studies have demonstrated that unemployment levels in port regions that have witnessed a decline in port related jobs due to containerization are significantly lower than in other regions.

Even though the relevance of employment numbers is limited, few studies have measured the quality of this employment (e.g. educational or wage level). We argue that in a context of dramatic jobs decrease and changing characteristics of employment in an age of global logistics, the impact of a port on its economic and social environments (especially in advanced economies) may be better defined by the *quality* of employment rather than by the *volume* of employment. Several models of port - and port/city - evolution indicate the growing importance of the tertiary sector compared to the industrial sector (Ducruet and Lee 2006). Indicators of port performance shall be adapted to this

evolution from core functions (e.g., loading, unloading) to broader functions, with the “increasing variety of products and services provided by a variety of firms” (de Langen et al. 2006).

Throughout history, port activities have been associated with low-skilled workforce, insecurity, immigration, and polluted environments. Although this negative image has gradually changed due to active urban regeneration, this image is still present. The increased competition between regions for investments and the related attention for “good business environments” has left port cities struggling to bend investors’ perceptions. Urban attractiveness rankings in Europe show lower scores of port cities compared to non-port cities. However, as seen in the U.S., the period following the deregulation stemming from the Shipping Act (1984) has seen an increase in the number and wage of the dockworkers, due to more bargaining power for negotiation from labor unions, and the need for improved port services from shipping lines (Peoples and Talley 2004). It is believed that the outcomes of such negotiations vary from one port area to another within the same country, depending on local and regional conditions. Thus, attention for qualitative indicators of a port’s impact on the regional economy through a comparative approach is warranted.

The first section of the paper introduces the advantages of shifting from usual port performance / impact measures to qualitative measures, and introduces the average wage level (AWL) as a new port performance indicator. The second section raises a series of methodological issues concerning the appropriate application of the AWL to ports. The third section provides an application of the AWL to the case of U.S. port counties. Finally, conclusions are drawn and implications for further studies in the field of port performance evaluation discussed.

2. AVERAGE WAGE LEVEL COMPARED TO OTHER PORT PERFORMANCE INDICATORS

2.1 Definition and usual measures of port performance

As indicated by the French geographer Roger Brunet (1993), *performance* can be defined by the “capacity to produce positive results” that is, therefore, depending on expectations. This also applies to ports, where quantitative measures of performance are widely used (see e.g. Marlow and Casaca 2003), but benchmark levels are rarely established. Table 1 summarizes the main port performance indicators (PPIs).

Among those indicators, value added and employment are the widely used for comparing the economic performance of seaports. They reflect the nature of a port as a “logistics and industrial centre, playing an important role in global industrial and logistics networks” (Notteboom 2001). De Langen et al. (2006) distinguish three different port products, the transport node, the logistics product and the manufacturing product, each with different port performance indicators. This is because the competitive position, infrastructure requirements, market structure and dynamics, and governance mechanisms of these three products differ substantially. This study provides an overview of existing and new port performance indicators, but does not provide methods to calculate new port performance indicators, nor addresses issues of data availability, collection and comparability.

[Insert Table 1 about here]

As seen in Table 1, most indicators of port performance are based on a *volume*, of goods, value added or employment. This approach has remained unchanged since the beginning

of the container revolution (Bird 1973; Chang 1978; Vigarié 1979; Vallega 1983). However, recent studies criticize economic impact studies because ports are no longer generators of revenues or employment in the context of increasing mechanization, industrial relocation and port-city separation (Benacchio et al. 2001). It is increasingly impossible to provide a convincing method to identify port related industries. Many economic activities located in port regions are to some extent port related. Most case studies dealing with port-related employment concentrate on one single place, while a minority deals with nationwide or European samples, but no uniform method to quantify port employment has been developed¹.

Although port-related employment volumes are still center stage in economic impact studies of ports, it does not do justice to the role of ports in advanced economies (Vallega 1996; Seassaro 1996; Pesquera and Ruiz 1996; Haynes et al. 1997; Silva and de Sousa 2001). Several authors have argued that ports have refined their activities to broader services, encompassing a wide set of impacts in the maritime-urban tertiary sector (Le Chevalier 1992; Vérot 1993; Amato 1999; Baudouin 2001; Beaurain 2001; Ducruet and Lee 2006). Because the complexity of port performance cannot be entirely measured with traditional tools, additional performance indicators are needed, together with the widening of the concept of port performance itself.

2.2 Advantages of the average wage level as PPI

As opposed to the *volume* of employment generated in a given place such as port area, port city, and port region, the average wage level of port industries (hereafter ‘AWL’)

¹ Some scholars have managed to measure some elements of port performance on a European and world scale in order to verify general rules and regional factors, but the quality and precision of local data gets lower as the sample of ports gets larger (see Table 1).

focuses on the *quality* of the contribution of a port to the regional economy². The measurement of AWL is relevant for the prosperity and economic performance of geographical areas. Porter (2003) uses average wage levels for all industries as main indicator to assess the performance of regions.

Wage levels depend on the nature of jobs and therefore indicate the wealth of a given area (Blanchard 2000). Wage levels reflect the educational level, skills and knowledge, in terms of human capital (Pigou 1928; Davenport and Niven, 1997) and the broader interaction between knowledge and economic activity (Kuznets 1971). Furthermore, there is recognition that human capital has an impact on regional innovation (Verspagen 1997; Florida 2002; Howells 2005) which, in turn, fosters regional economic growth.

This particularly applies to ports, where multiple activities of different nature take place, from routine to decisional activities. Given the diversity of economic linkages between port activities and other activities (industry, tertiary), ports are seen as clusters of economic activities. Consequently, performance indicators applied to clusters, such as average wage level (Porter, 2003) can also be applied to ports. However, applying AWL necessitates important clarifications of methodological issues.

3. AVERAGE WAGE LEVEL; METHODOLOGICAL ISSUES

Three questions have to be addressed to develop a method to calculate the average wage level of port industries in port regions:

1. What industries are regarded as port industries?
2. What regions are considered as 'port regions'?
3. How can the average wage level of port industries be compared across regions?

² This is in line with performance measurement in general. Kaplan and Norton (1996) in their 'Balanced Scorecard' explicitly consider skills and knowledge of major importance, in addition to financial indicators such as profit and turnover.

These questions are addressed in the following three paragraphs. The application of the method to the US is presented in the last paragraph

3.1 Defining port industries

Based on the North American Industry Classification System (NAICS), which replaced the U.S. Standard Industrial Classification (SIC) in 1997, De Langen (2004) has provided a typology of port-related industries (Table 2).

[Insert Table 2 about here]

3.2 Defining port regions

The lack of currency and language difference makes the data for the average wage level in the USA relatively easy to compare. Europe, for example is a more difficult ground to study port wage level because a comprehensive database is lacking.

The states in the USA are divided into geographical subdivisions: counties. Because the borders of ports are often not equal to the borders of a county, multiple counties can embed a part of the port and thus can have employment in port activities. Porter states in ‘The Economic Performance of Regions’ (2003) that essential determinants of economic performance can be found on a regional level. One of the determinants that can be used to measure this economic performance is the average wage level of the region.

The collection of wage level data is not available for ports as an entity, but personal wage data at county level is available. Although administrative boundaries are often mismatched with the port or urban influential local areas, which are more of functional nature, county-based employment and wage level is very precise and comparable throughout the country. The US labor department has a database with wage level and

employment statistics at county level for individual North American Industry Classification System (NAICS) codes. To exclude possible state differences, wage levels in port counties are compared to state levels. This method has been fruitful to analyze port impacts in Europe in a recent study (Rozenblat 2004). Notably, the ratio between local and national unemployment rates helps putting in question the inevitable worsened social situation of port cities in general, while indicating which port cities are more struck by unemployment than others.

The ports that are included in the case study are selected based on their throughput. The port sample is established by selecting the 10 largest US ports in tons of throughput in the year 2004 and the 10 largest ports in TEU container throughput for the same year. A sample of 17 ports remained because some ports are selected by both selection criteria.

The port counties are selected based on:

- Presence of port activities in the county;
- Substantial specialization in port activities.

The county specialization in port activities is calculated based on the specialization of employment and the number of establishments in 2003. The criteria for which counties are port counties are based on number of establishments and the employment in NAICS code 4883 “support activities for water transportation”, which encompasses the basic port activities³. The final selection of the port counties is done by the following criteria, resulting in Table 3 and which are all related to the NAICS 4883:

- > 20 establishments; or
- one establishment only and,

³ The US Census Bureau gives the exact activities.

- 1.5 x the specialization of the state and,
- 2 x the specialization of the USA and,
- 100 employees and,
- county location quotient of at least 1.5 compared to the state.

[Insert Table 3 about here]

Following the identification of port counties, their economic specialization is analyzed through the importance of the different port industries. The types are distinguished according to the following criteria based on location quotients:

- Freight-related activities: $LQ \text{ establishments} + LQ \text{ employment} > 4$
- Logistics activities: $LQ \text{ establishments} + LQ \text{ employment} \geq 3$
- Manufacturing activities: $LQ \text{ establishments} + LQ \text{ employment} \geq 6$
- Trade activities: $LQ \text{ establishments} + LQ \text{ employment} \geq 3$

Based on these specialization ratios, 6 types of port counties are distinguished according to the combinations of activities:

- Value added port: freight / logistics / manufacturing
- Trade and manufacturing port: manufacturing / trade
- Manufacturing port: manufacturing
- Logistics port: logistics
- Gateway port: freight
- Non-specialized port: no remarkable specialization

3.3 Comparing wage levels across industries

A first application on a state level is provided in Figure 1. Variables are restricted to port-related data such as employment and average income in water transportation for states and related port counties, together with total port traffics by state. It shows to what extent previous PPIs such as traffic volumes of total employment are limited to differentiate port regions. For instance, average wage levels for the state or the port counties are not well matched with the ranking of traffic volumes or employment totals, except for Louisiana and Texas. Similarly, New Jersey, Louisiana, Kentucky and Washington states generate lower employment volumes while their average wage levels (state and port counties) are higher than in other areas. Conversely, four states combine low scores in all variables: South Carolina, Virginia, West Virginia, and Ohio. At the end, correlations among the different PPIs are quite low, as showed in Table 4.

[Insert Figure 1 about here]

[Insert Table 4 about here]

4. APPLICATION TO U.S. PORT COUNTIES

4.1 Preliminary outcomes

The evaluation of differentials between wage levels in port industries and wage levels in general is stressed by a single formula:

$$PCP = (WL_{port}^c / WL_{port}^{st}) / (WL_{overall}^c / WL_{overall}^{st})$$

Where:

PCP denotes port county performance

‘ WL_{port} ’ is the average wage level in port-related activities

‘ $WL_{overall}$ ’ is the average overall wage level

‘c’ denotes the relevant county, while ‘st’ denotes the state

According to the results of the formula, it is possible to know whether the performance of port regions stems from port industries or not. Values higher than ‘1’ would indicate a higher performance of port industries compared to other industries, and relatively to the rest of the wider area - here the State. Conversely, values lower than ‘1’ would illustrate a lower performance of port industries. Due to the current limitations of data we will limit the application of this formula and consider only port-related activities.

Based on the data collected and provided in Annex table, a series of tests is made possible to verify the fundamentals of the degree and distribution of AWLs. The quality of the port’s environment and the degree of port performance may be influenced by various factors that make every place unique. In parallel, there might be some ‘rules’ which underlie the formation of an AWL.

As seen in Figure 2, AWL county/state ratio shows interesting relationships with county/state concentration ratios for population and employment in transport and warehousing for most port counties:

- Port counties with a lower population / employment relative concentration have also a lower - or comparable - AWL than the state, except for 7 counties

(Norfolk, Portsmouth, Richmond, St. Bernard, St. Charles, St. James, and Wayne);

- Port counties with a higher population / employment relative concentration have also a higher - or comparable - AWL than the state, except for 4 counties (Hudson, Charleston, Jefferson, and Pierce).

[Insert Figure 2 about here]

Despite the low correlations between AWL state ratio and population (0.238) and transport employment (0.243) concentrations, the ‘weight’ of the county within its outlying territory has undoubtedly some significance in the level of wages in port-related activities (Table 5). Reasons could be that denser urban environments are more competitive markets and have more efficient labor regulations than suburban areas or relatively isolated economic zones. However, several cases are not matched. Also, the geographical distribution of those cases is not consistent enough to explaining AWL variation by regional factors. Thus, further verification is needed, by looking at the economic specializations of the port counties.

4.2 Economic specialization and average wage level

At first glance, there is no direct relation between types and AWL on an individual basis. Low and high AWL are relatively mixed. However, ‘value added port’, ‘gateway port’, and ‘non-specialized port’ have higher scores on an average basis, despite internal differences within each category. Also, the level of population and employment concentration is diversely distributed among the different types when compared with Figure 1. But still, ‘logistics port’ and ‘non-specialized port’ categories have an important

share of counties concentrating population and employment. This may illustrate that urban areas are more diversified than other areas, but also the need for logistics activities to “stay as close to their customers as possible” (Goetz and Rodrigue 2004), i.e. within or nearby densely populated areas, like New York and Los Angeles.

[Insert Table 5 about here]

On the other side, ‘trade and manufacturing port’ and ‘manufacturing port’ combine lower AWL and lower urban / employment concentrations compared to state levels. This would also apply to ‘value added port’ if St. Charles county was excluded. Thus, socio-economic environments share a common logic with the relative size of local units, but still this is not sufficient to explain AWL differentials. In every category can be found a high and a low AWL, except for ‘gateway port’ but this is funded on only two counties and should be researched more.

The different categories proposed in the typology need a more scrutinized analysis. On the one hand, specialization in freight tends to increase wage levels, but on the other hand, additional specializations in manufacturing, logistics and trade have a negative effect on the county/state ratio. The few remarkable exceptions (i.e. Harris, Union, and King) are those located within very large urban areas (New York, Los Angeles). It means that for port counties located outside main urban areas, the apparent economic diversity hides a domination of lower-skilled workforce around the port. Office workers are not attracted by port functions and tend to locate in the remotely / centrally located head office, i.e. outside the port county in the related State. Still, the relative importance of blue-collars and white-collars is important to differentiate the levels of port performance among a given area. It would also mean that the activities attracted by the port - the port

cluster - bring less prosperity and are potentially less innovative than the same activities outside the port. Conversely, port counties specialized in their core activity, with a lesser importance of other industries, have a higher performance in terms of average wage levels in transport and warehousing. For those counties, the port is the leading economic engine and is not likely to be challenged by equivalent activities in other parts of the State. Only the counties corresponding to the central areas of large cities are able to perform positively while operating other functions than the port.

5. CONCLUSIVE REMARKS

The majority of port performance studies have measured port impacts in terms of size indicators (e.g. volumes of throughput, employment, and value added). This research argues that qualitative measures are at least equally important, especially in advanced economies. Average wage level is an interesting qualitative performance indicator, because it reflects the quality of the ports' economic and social environments. In several countries, maritime office activities tend to follow the urban hierarchy rather than the hierarchy of port volumes, such as the Canadian (Slack, 1989) and Australian (O'Connor, 1989) cases. This may be partially explained by the limited attractiveness of port cities for 'knowledge workers'. This paper presents a study of average wage levels in port counties, to get a better understanding of factors that drive wage development in port cities. It turns out that there is no straightforward relation between the specialization of a port and its relative average wages. The size of the port city does seem to have an effect, but further research is required to fully understand what drives wage levels in port regions. Further research could also pay more attention to the size (MNCs, small and medium) and statute (public or private, head office, branch or outsourced) of port related companies.

REFERENCES

- Amato, D. (1999): "Port Planning and Port-city Relations," *The Dock and Harbour Authority*, July-December: 45-48.
- Backx, J.P. (1929): "De Haven van Rotterdam," Thesis, Rotterdam.
- Banister, D. (1995): "Transport and Urban Development," Alexandrine Press, Oxford.
- Baudouin, T. (2001): "Les Villes Portuaires, Interfaces Essentiels des Territoires de la Mondialisation," in *Les Territoires de la Ville Portuaire*, International Association Cities and Ports, 23-27.
- Beaurain, C. (2001): "Places Portuaires et Hinterland Economique: Les Enjeux Autour de la Localisation des Services," in *Les Territoires de la Ville Portuaire*, International Association Cities and Ports, 37-50.
- Benacchio, M., Ferrari, C., Haralambides, H.E. and Musso, E. (2001): "On the Economic Impact of Ports: Local vs. National Costs and Benefits," *World Conference on Transport Research*, Seoul Conference, July 22-27.
- Bird, J. (1973): "Of Central Places, Cities and Seaports," *Geography*, 58: 105-118.
- Blanchard, O. (2000): "Macroeconomics," Prentice Hall Inc., Upper Saddle River NJ.
- Chang, S. (1978): "In Defence of Port Economic Impact Studies," *Transportation Journal*, 17: 79-85.
- Charlier, J. (1994): "Sur le Concept de Tonnages Pondérés en Economie Portuaire," *Les Cahiers Scientifiques du Transport*, 29: 75-84.
- Comtois, C. and Slack, B. (2005): "Sustainable Development and Corporate Strategies of the Maritime Industry," *International Workshop on New Generation Port Cities and their Role in Global Supply Chains*, Hong Kong, December 12-14.
- Davenport, T.O. and Niven, P.R. (1997): "Human Capital," Jossey Bass, San Francisco.
- Ducruet, C. (2005): "Approche Comparée du Développement des Villes-Ports à l'Echelle Mondiale: Problèmes Théoriques et Méthodologiques," *Les Cahiers Scientifiques du Transport*, 48: 59-79.
- Ducruet, C. (2007): "A Metageography of Port-city Relationships," in Wang, J.J., Olivier, D., Notteboom, T. and Slack, B. (eds) *Inserting Port Cities in Global Supply Chains*, Ashgate (forthcoming).
- Ducruet, C., Joly, O. and Martell, H. (2005): "Air-sea Linkages in European Port Cities," in Fredouet, C.H. and Rimmer, P.J. (eds) *International Transport and Logistics: East Asian and European Experiences*, Routledge (forthcoming).
- Ducruet, C. and Lee, S.W. (2006): "Frontline Soldiers of Globalization: Port-city Evolution and Regional Competition," *GeoJournal*, 67(2): 107-122.
- Ducruet, C. and Lee, S.W. (2007): "Measuring Intermodalism at European Port Cities: An Employment-based Approach," *IAME Conference* (submitted).
- Dumay, B. (2006): "Average Wage Levels in US Port Counties," Master Thesis, Erasmus University, Rotterdam.

- Florida, R. (2002): "The Economic Geography of Talent," *Annals of the Association of American Geographers*, 92(4): 743-755.
- Goetz, A.R. and Rodrigue, J.P. (2004): "Transport Terminals: New Perspectives," *Journal of Transport Geography*, 7: 237-240.
- Gordon, I.R. and McCann, P. (2000): "Industrial Clusters: Complexes, Agglomeration and/or Social Networks?," *Urban Studies*, 37: 513-532.
- Gripaios, R. (1999): "Ports and Their Influence on Local Economies: A UK Perspective," *The Dock and Harbour Authority*, 79: 235-241.
- Gripaios, P. and Gripaios, R. (1995): "The Impact of a Port on Its Local Economy: the Case of Plymouth," *Maritime Policy and Management*, 22(1): 13-23.
- Haezendonck, E. (2001): "Essays on Strategy Analysis for Seaports," Garant, Leuven-Apeldoorn.
- Haynes, K.E., Hsing, Y.M. and Stough, M.M. (1997): "Regional Port Dynamics in the Global Economy: The Case of Kaohsiung, Taiwan," *Maritime Policy and Management*, 24(1): 93-113.
- Howells, J. (2005): "Innovation and Regional Development: A Matter of Perspective?," *Research Policy*, 34: 1220-1234.
- Joly, O. (1999): "La Structuration des Réseaux de Circulation Maritime," Unpublished PhD dissertation in Territorial Management, Le Havre University.
- Joly, O. and Martell, H. (2003): "Infrastructure Benchmarks for European Container Ports," 4th Inha-Le Havre International Conference, Incheon, October 8-9.
- Kaplan, R.S. and Norton, D.P. (1996): "The Balanced Scorecard, Translating Strategy into Action," Harvard Business School Press, Boston MA.
- Krugman, P. (1991): "Geography and Trade," MIT Press, Cambridge MA.
- Kuznets, S. (1971): "Economic Growth of Nations: Total Output and Production Structure," Belknap, Harvard.
- Langen, P.W. de (2004): "The Performance of Seaport Clusters: A Framework to Analyze Cluster Performance and An Application to the Seaport Clusters of Durban, Rotterdam and the Lower Mississippi," TRAIL Thesis Series, Delft.
- Langen, P.W. de (2005): "Seaports and Regional Economic Development," International Workshop on New Generation Port Cities and their Role in Global Supply Chains, Hong Kong, December 12-14.
- Langen, P.W. de, Nijdam, M.H. and van der Horst, M. (2006): "New Indicators to Measure Port Performance," Proceedings of the IAME Conference, July 12-14, Melbourne, Australia.
- Le Chevalier, F. (1992): "Le Commerce International Portuaire: Point d'Appui du Développement des Trafics Portuaires et du Tertiaire Urbain," *Journal de la Marine Marchande*, February 28th, 497-498.
- Marlow, P.B. and Casaca, A.C.P. (2003): "Measuring Lean Port Performance," *International Journal of Transport Management*, 1: 189-202.
- Musso, E., Benacchio, M. and Ferrari, C. (2000): "Ports and Employment in Port Cities," *International Journal of Maritime Economics*, 2(4): 283-312.

- O'Connor, K. (1989): "Australian Ports, Metropolitan Areas and Trade-Related Services," *Australian Geographer*, 20: 167-172.
- Peoples, J. and Talley, W.K. (2004): "Owner-operator Truck Driver Earnings and Employment: Port Cities and Deregulation," *Transportation Labor Issues and Regulatory Reform, Research in Transportation Economics*, 10: 191-213.
- Pesquera, M.A. and Ruiz, J.R. (1996): "Sustainable Development Strategies for Cities and Ports," U.N.C.T.A.D. Monographs on Port Management, 14, United Nations, New York and Geneva.
- Porter, M.E. (2003): "The Economic Performance of Regions," *Regional Studies*, 37(6/7): 549-578.
- Randall, J.E. (1988): "Economic Development and Non-marine Initiatives at American Seaports," *Maritime Policy and Management*, 15(3): 225-240.
- Rozenblat, C. (dir.) (2004): "Les Villes Portuaires en Europe: Analyse Comparative," Research Report, Maison de la Géographie, Montpellier.
- Seassaro, L. (1996): "Ville, Port et Contexte Extérieur: Le Cas des Acteurs Gênois," in Séminaire Européen sur les Waterfronts, International Association Cities and Ports, October 16-17, 1995, Paris, 147-194.
- Silva, V.R. and Sousa, J.F. de (2001): "Les Ports de Lisbonne et Sétubal dans l'Aire Métropolitaine de Lisbonne: Complémentarité ou Opposition?," in *Les Territoires de la Ville Portuaire*, International Association Cities and Ports, 83-93.
- Slack, B. (1989): "Port Services, Ports and the Urban Hierarchy," *Tijdschrift voor Economische En Sociale Geografie*, 80: 236-243.
- Slack, B. (2005): "The Terminalisation of Ports: An Academic Question?," International Workshop on New Generation Port Cities and their Role in Global Supply Chains, Hong Kong, December 12-14.
- Stopford, M. (1997): "Maritime Economics," Routledge, London & New York.
- Suykens, F. (1989): "The City and Its Port: An Economic Appraisal," *Geoforum*, 20(4): 437-445.
- Tongzon, J.L. (1995): "Systematizing International Benchmarking for Ports," *Maritime Policy and Management*, 22(2): 171-177.
- UNCTAD (1976): "Port Performance Indicators," United Nations, New York.
- Vallega, A. (1983): "Nodalité et Centralité Face à la Multimodalité: Éléments pour un Relais entre Théorie Régionale et Théorie des Transports," in Muscara, C. and Poli, C. (eds) *Transport Geography Facing Geography*, Dipartimento di Pianificazione Territoriale e Urbanistica, Roma, 69-88.
- Vallega, A. (1996): "Cityports, Coastal Zones and Sustainable Development," in Hoyle, B.S. (ed) *Cityports, Coastal zones and Regional Change*, John Wiley & Sons Ltd., Chichester, 295-306.
- Van der Lugt, L.M. and Nijdam, M.H. (2005): "The Changing Role of Ports as Locations for Logistics Activities," SUTRANET WP3, Positioning Paper for Case Studies on Logistics, Erasmus University Rotterdam.
- Vérot, P. (1993): "De la Crise des Ports au Renouveau des Villes Littorales," *Mappemonde*, 1: 40-43.

Verspagen, B. (1997): "European 'Regional Clubs': Do They Exist, and What Are They Heading?," MERIT, Maastricht.

Vigarié, A. (1979): "Ports de Commerce et Vie Littorale," Hachette, Paris.

Vleugels, R.L.M. (1969): "The Economic Impact of Ports on the Regions They Serve and the Role of Industrial Development," International Association of Ports and Harbors, Australian Conference, 239-247.

Wang, J.J. and Olivier, D. (2003): "La Gouvernance des Ports et la Relation Ville-Port en Chine," Les Cahiers Scientifiques du Transport, 44: 25-54.

Witherick, M.E. (1981): "Port Development, Port-city Linkages and Prospects for Maritime Industry: A Case Study of Southampton," in Hoyle, B.S. and Pinder, D.A. (eds) Cityport Industrialization and Regional Development, Pergamon Press, Oxford, 113-132.

Type	Principles	Advantages	Disadvantages	Examples
Throughput(s)	Ports as transshipment nodes	Provided by most port authorities and usually comparable	Difficulty to compare different cargo traffics and lack of precision of traffic totals	Backx (1929) UNCTAD (1976) Tongzon (1995) Slack (2005)
Value Added	Expenses on labor, depreciation and profit	Better reflects the value of cargoes passing through the port (cf. <i>weighting rules</i>)	Difficult to measure and compare; diversity of the activities involved (e.g. cargo reprocessing, packing, repacking, labeling, inspection, etc.)	Vleugels (1969) Randall (1988) Suykens (1989) Charlier (1994) Haezendonck (2001) Langen de (2004)
Employment	Ports as clusters of economic activities	Direct indicator of port economic impact on the local / regional areas	Difficulty to assess the effective linkages between port activities and various industries	Witherick (1981) Krugman (1991) Gripaios & Gripaios (1995) Gripaios (1999) Stopford (1997) Gordon & McCann (2000) Musso et al. (2000) Langen de (2004) Nijdam & van der Lugt (2005)
Others	<ul style="list-style-type: none"> • Port connexity index in the world maritime system (Joly, 1999) • Intermodalism from infrastructure benchmark (Joly & Martell, 2003) or employment (Ducruet et al., 2005; Ducruet & Lee, 2007) • Position among a port range, such as market share by port / shipping line (Fremont & Soppe, 2005) • Port-urban relative concentration index (Ducruet & Lee, 2006), gradients of centrality / intermediacy (Ducruet, 2005), types of transport chain integration (Ducruet, 2007) • Regulations, such as environmental issues (Comtois & Slack, 2005), port governance (Wang & Olivier, 2003) • Port attractivity for firms, specializations, urban radiance, continental accessibility, unemployment rate, redevelopment dynamics at the port-city interface, image marketing and communication (Rozenblat, 2004) 			

Table 1: Types of port performance indicators

	NAICS Code	Description	Specialization
Manufacturing	22111	Electric power generation	0.70
	23712	Oil & gas pipeline and related structures construction	0.98
	3112	Grain & oilseed milling	0.81
	311211	Flour milling	0.55
	311225	Fats & oils refining and blending	1.32
	311412	Frozen specialty food manufacturing	1.46
	31142	Fruit & vegetable canning, pickling and drying	0.83
	3221	Pulp, paper & paperboard mills	0.69
	324	Petroleum refineries	1.01
	3251	Basic chemical manufacturing	1.44
	3252	Rubber and fibers manufacturing	1.15
	3315	Foundries	0.84
	336611	Shipbuilding and repairing	3.17
Trade	8113	Commercial & industrial machinery and equipment	0.95
	4235	Metal & mineral (except petroleum) merchant wholesalers	1.42
	42386	Transportation equipment & supplies (except motor vehicle) merchant wholesalers	2.41
	42393	Recyclable material merchant wholesalers	1.11
	4246	Chemical & allied products merchant wholesalers	1.23
	4247	Petroleum & petroleum products merchant wholesalers	0.89
	52313	Commodity contracts dealing	2.53
Transport	52314	Commodity contracts brokerage	1.92
	48	Transport & warehousing	1.03
	483	Water transportation	3.15
	483111	Deep sea freight transportation	3.46
	483112	Deep sea passenger transportation	2.87
	483113	Coastal & Great Lakes freight transportation	3.40
	483211	Inland water freight transportation	3.41
	48411	General freight trucking, local	1.05
	48412	General freight trucking, long distance	0.64
	4842	Specialized freight trucking	0.66
	4861	Pipeline transportation of crude oil	1.47
	4862	Pipeline transportation of natural gas	0.89
Cargo handling	4869	Other pipeline transportation	0.89
	492	Couriers & messengers	1.17
	488	Support activities for transportation	1.74
	48831	Port & harbour operation	2.55
	48832	Marine cargo handling	4.10
	48833	National services to shipping	3.52
	48839	Other support activities for water transportation	3.74
	4884	Support activities for road transportation	1.09
Logistics	4885	Freight transportation arrangement	2.03
	4889	Other support activities for transportation	1.41
	493	Warehousing & storage	1.15
	49311	General warehousing & storage	1.19
	49312	Refrigerated warehousing & storage	0.95
	49313	Farm product warehousing & storage	0.48
	49319	Other warehousing & storage	1.28

Table 2: Specialization levels in port-related activities

Port	Port Counties	State
Baton rouge	West Baton Rouge	Louisiana
Beaumont	Jefferson	Texas
Charleston	Berkeley, Charleston	South Carolina
Corpus Christi	Nueces	Texas
Hampton Roads	Norfolk, Portsmouth, Newport News, Chesapeake	Virginia
Houston	Harris	Texas
Huntington	Wayne, Lawrence, Boyd	West Virginia, Ohio, Kentucky
LA/Long Beach	Los Angeles	California
New Orleans	Jefferson, Orleans, ST. Bernard	Louisiana
New York & New Jersey	Richmond, Union, Hudson	New York & New Jersey
Oakland	Alameda, Solano	California
Savannah	Chatham	Georgia
Seattle	King	Washington
South Louisiana	St. Charles, Ascension, St. John the Baptist, St James	Louisiana
Tacoma	Pierce	Washington
Texas City	Galveston	Texas

Table 3: Selected port counties

	State Average Income	Employment in port counties	Total State Traffics (tons)	AWL in port counties
State Total Employment	0.378	0.804	0.370	0.117
State Average Income	-	0.465	0.248	0.434
Employment in port counties	-	-	0.425	0.163
Total State Traffics (tons)	-	-	-	0.304

Table 4: Correlation levels of selected PPIs among U.S. states, 2003

<i>[Absolute]</i>	Average income	Total population
Average income	1.000	0.302
Total employment	0.394	0.972

<i>[Relative]</i>	Average wage level	Population concentration
Average wage level	1.000	0.238
Employment concentration	0.243	0.863

Table 5: Correlation indexes

Port	Port Counties	Freight	Logistics	Manufacturing	Trade	AWL	AWL (average)
Value added port	West Baton Rouge	1	1	1	1	0.95	1.12
	St. Charles	1	1	1	1	1.35	
	Wayne	1	1	1	0	1.07	
Trade & manufacturing port	Jefferson LA	1	0	1	1	0.93	0.99
	Ascension	1	0	1	1	1.01	
	St. John	1	0	1	1	0.90	
	St James	1	0	1	1	1.09	
	Jefferson TX	0	0	1	1	0.84	
	Harris	0	0	1	1	1.23	
	Boyd	0	0	1	1	0.96	
Manufacturing port	ST. Bernard	1	0	1	0	1.08	0.91
	Galveston	0	0	1	0	0.90	
	Nueces	0	0	1	0	0.86	
	Newport News	0	0	1	0	0.80	
Logistics port	Berkeley	0	1	0	0	0.93	0.96
	Chatham	0	1	0	0	0.80	
	Union	0	1	0	0	1.24	
	Pierce	0	1	0	0	0.93	
	Chesapeake	0	1	0	0	0.99	
	Hudson	1	1	0	0	0.89	
Gateway port	Norfolk	1	0	0	0	1.24	1.20
	Richmond	1	0	0	0	1.17	
Non-specialized port	Charleston	0	0	0	0	1.00	1.01
	Portsmouth	0	0	0	0	1.13	
	Lawrence	0	0	0	0	0.92	
	Orleans	0	0	0	0	1.03	
	Los Angeles	0	0	0	0	1.07	
	Alameda	0	0	0	0	-	
	King	0	0	0	0	1.12	
	Solano	0	0	0	0	0.83	
AWL	All counties	1.06	1.01	0.99	1.02		
	Exclusive	1.20	0.97	0.91	-		

Table 6: AWL by port county and specialization in 2003*

** Bold values represent a higher concentration of population and employment*

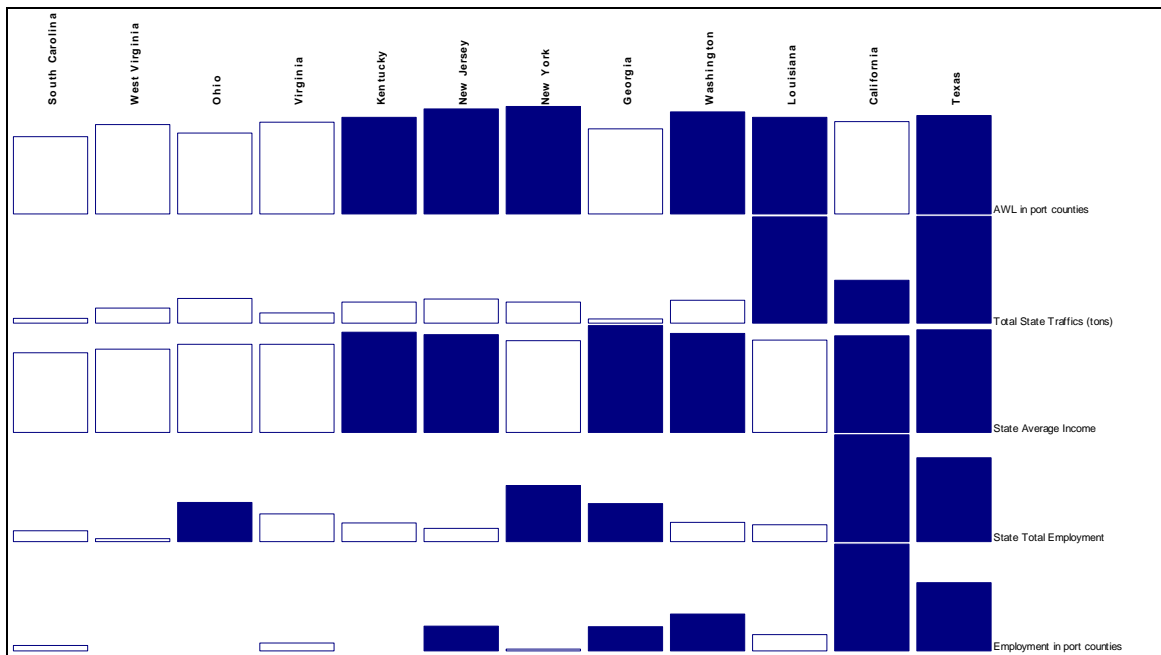


Figure 1: Comparison of selected PPIs by U.S. state, 2003*

Data source: US Census Bureau

* values in bold are higher the row's average

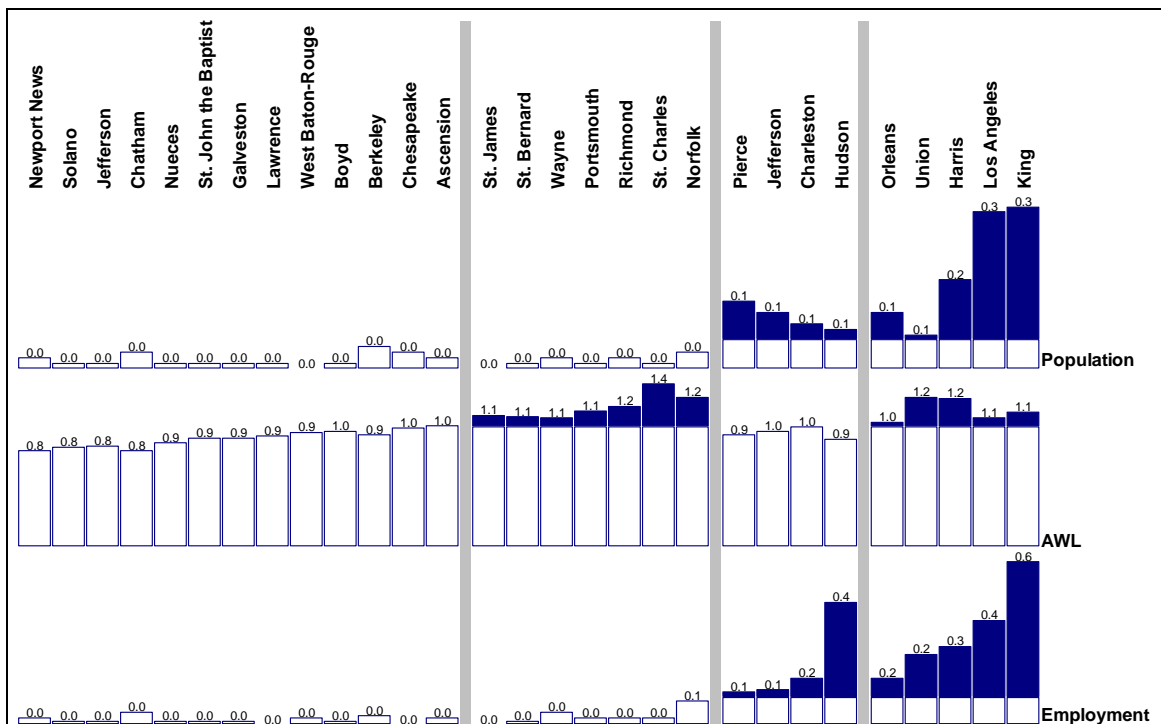


Figure 2: County/state ratios for AWL, transport employment and population, 2003*

Data source: US Census Bureau

* values in bold are higher the row's average

APPENDIX 1

State	Employment	AVG income (a)	Port county	Employment	AVG income (b)	Ratio (b) / (a)
South Carolina	47173	32560	Berkeley	1612	30530	0.93
			Charleston	7735	32877	1.00
West Virginia	15993	34030	Wayne	664	36548	1.07
Ohio	152185	35828	Lawrence	700	33103	0.92
Virginia	108829	35844	Chesapeake	43	35627	0.99
			Newport News	2362	28827	0.80
			Norfolk	8567	44603	1.24
			Portsmouth	1639	40591	1.13
New York	214953	37313	Richmond	4144	43689	1.17
Louisiana	68208	37532	Ascension	1292	37921	1.01
			Jefferson	8167	36048	0.96
			Orleans	10818	39009	1.03
			St. Bernard	712	40741	1.08
			St. Charles	1172	51012	1.35
			St. James	332	41159	1.09
			St. John the Baptist	678	34117	0.90
			West Baton-Rouge	1101	35882	0.95
California	406254	39421	Alameda	-	-	-
			Los Angeles	144396	42518	1.07
			Solano	2910	32739	0.83
New Jersey	54210	39910	Hudson	22858	35806	0.89
			Union	12852	49864	1.24
Washington	77394	40379	King	43555	45392	1.12
			Pierce	8291	37676	0.93
Kentucky	75783	40738	Boyd	1040	39444	0.96
Texas	319405	41704	Galveston	1938	37593	0.90
			Harris	85638	51629	1.23
			Jefferson	3160	35077	0.84
			Nueces	3997	36082	0.86
Georgia	147487	43568	Chatham	6481	34888	0.80

AWL county/state differentials in “transport and warehousing” by port county in 2003

Source: US Census Bureau